RESOURCE B

Making science whole: Embedding social science in natural science workflows

Introduction

Changes in the Sacramento-San Joaquin Delta and Suisun Marsh (collectively referred to herein as Delta; California Water Code § 85058), the San Francisco Bay-Delta (Bay-Delta) system, the broader San Francisco Estuary, and many other complex social-ecological systems are outpacing traditional approaches to science and management, underlining the need for researchers and natural resource managers to prioritize and respond with limited resources (Lee et al., 2024). The social sciences help navigate and ameliorate these management challenges by understanding emerging behavior changes throughout the social-ecological system (Biedenweg et al., 2020) (Box B-1). For example, the Delta Stewardship Council's (Council) 2023 Delta Residents Survey (DRS) revealed key concerns among Delta residents regarding where they obtain information, whom they trust, and their top priorities (Rudnick et al., 2023; see also Case Study 1). Insights like these can inform which projects should be funded to maximize impact, and how communities engage in conservation, restoration,

BOX B-1

THE DIVERSITY OF THE SOCIAL SCIENCES

The social sciences are the systematic study of classic disciplines (e.g., anthropology, sociology, economics, political science, psychology) and applied disciplines (e.g., education, communications) (Niemiec et al., 2021). Together they work to "understand, describe, theorize, deconstruct, imagine, or plan" social phenomena (Bennett et al., 2017). These fields range from environmental economics – asking questions like: How much are people willing to pay for clean water? What incentives are needed to improve conservation behaviors? – to environmental governance – asking questions like: What formal and informal rules affect conservation outcomes? The social sciences can be used to understand how to communicate climate change in a way that resonates, how community values influence restoration priorities, or how institutions collaborate (or not) for co-management. Different social science fields and methodologies use a wide range of assumptions, theories, and epistemologies, so they are not interchangeable or equally useful for all questions. Understanding the right tool for the right problem is key.

and research – ultimately making science and science investments more comprehensive, relevant, actionable, and successful.

Despite this demonstrated value, social science remains underutilized in Delta conservation, restoration, and water management (Bennett et al., 2017; Biedenweg et al., 2020; Fox et al., 2006). The purpose of this resource is to demystify common myths about social science and provide natural scientists with practical entry points for collaborating with social scientists and utilizing social science data. Examples in this document highlight success stories in the social sciences, as well as possible ways for academic researchers, agency scientists, and managers to directly engage in or support social science integration efforts in the Delta.

Myth 1: Social science is a soft science

Social science is often dismissed as "soft," implying it is less objective, less empirical, or less scientific than fields like biology, chemistry, or physics. This myth persists in part because social science deals with human behavior, values, and institutions – domains that are dynamic, variable, and hard to design a control group or test alternative scenarios. However, this complexity is countered by rigorous methods. Social scientists require many of the same elements as researchers in the natural sciences: they develop hypotheses, conduct experiments, construct and operate theoretical frameworks, collect empirical data, and use systematic methods or modeling to test and refine the hypotheses. For example, a conservation social scientist might hypothesize that decentralized water governance leads to more adaptive policy outcomes. A null hypothesis would posit that there is no relationship. They could test this using comparative case studies, regression models, or even experimental designs. Interested yet? Such studies have already been conducted by Andersson and Ostrom (2008). Similarly, a sociologist studying public trust in science might design a randomized survey experiment to test whether different message framings influence attitudes toward environmental policy (Ophir & Jamieson, 2021) or marine conservation behaviors (Kolandai-Matchett & Armoudian, 2020) – methods directly analogous to experiments in the natural sciences. For more background and examples, see the Delta Social Science Task Force report (Biedenweg et al., 2020).

Myth 2: Social science is just public participation

Social science is often misunderstood as merely facilitating public engagement or communication. In environmental management and policy, this leads to the misconception that social scientists are only valid after technical work is complete, to "translate" science for the public, or to help check

Photo: Researchers share insights from landowner interviews at the Suisun Marsh Spring Landowner Workshop, highlighting strong support for collective action to manage Phragmites, an invasive plant that has increased in cover by over 230% between 2003 and 2018. See Case Study 2 for more information. **Credit:** Zhao Ma.

an engagement box. While participatory methods, such as interviews, focus groups, or co-design, are valuable components of some social science approaches, they represent only a fraction of the field's full scope. For example, political science and institutional analysis help illuminate why specific governance arrangements succeed or fail in managing shared resources (Ostrom, 1990). Behavioral economics uses data and experimental designs to identify how cognitive biases and heuristics influence decision-making under deep uncertainty (Independent Science Board, 2024; Shogren et al., 2010; Tversky & Kahneman, 1974). Sociology and human geography provide critical insights into how power, culture, and identity shape environmental conflict, collaboration, and knowledge production (Escobar, 2008; Forsyth, 2003). These contributions go well beyond outreach – they are foundational to gaining insights or testing ideas as part of feasible, equitable, and effective research. Evidence-based insights from social science promote socially viable solutions to natural resource concerns, but social scientists need to be involved early enough to shape the solutions under consideration, rather than being brought in late in the process.

Easy entry points to social science

What are the easy entry points for natural scientists and managers interested in the social sciences?

1. COLLABORATE WITH SOCIAL SCIENTISTS EARLY IN THE RESEARCH PROCESS

Ignoring social science until the natural science research is ready to be implemented often results in solutions that are sound in theory but socially unviable. One of the benefits of involving social scientists early on is the ability to help predict how people may adapt or change their behavior in ways unexpected by natural resource managers. For example, a Kansas cost-share program that subsidized water-saving irrigation technologies – intended to reduce groundwater extraction – instead found that participating farmers expanded irrigated acreage, offsetting the expected water saving (Pfeiffer & Lin, 2014). So, social scientists can be valuable members of teams devising regulations or incentives to enhance their effectiveness at meeting resource goals.

When conducting surveys, interviews, workshops, or other work involving research on and with people, the best way to ensure that the data is collected ethically is to work with a social scientist. Social scientists can help determine whether Institutional Review Board (IRB) requirements for human subjects research are necessary, design ethically sound studies, including identifying the most relevant questions to ask and determining the optimal order, and enhance data quality. The consequence of conducting research without IRB approval can be severe: suspension of research, loss of funding, publication retraction, legal liability if participants are harmed, and damage to your credibility and professional reputation. See Box B-2 on where to find social scientists.

BOX B-2

WHERE DO I FIND A SOCIAL SCIENTIST?

There are many types of social scientists, and understanding the relevant disciplines for the question at hand will help with finding the right person for the right problem. Many social scientists are based at universities and research institutions, and relevant expertise can often be found in departments such as economics or sociology. Reviewing published research on related topics can also help identify appropriate collaborators. Alternatively, you can obtain customized research through consultants like Gallup, which designs surveys and conducts focus groups. In the Delta, you can explore the **Delta Stewardship Council's Social Science Integration Web page**[1] and the list of **Bay-Delta Social Science Community of Practice members**[2] interested in Delta human dimensions topics. If you're still searching for more information, reach out to the Delta Stewardship Council's Social Science Integration Team at **socialscience@deltacouncil.ca.gov**.

2. INTEGRATE SOCIAL DATA INTO MODELS AND ANALYSES

Social-ecological system models encompass social, ecological, and spatial scales – serving as an appropriate framework for natural and social scientists to bring together diverse interests and actors (Steger et al., 2020). Natural scientists are often already familiar with the range of data from which they can draw to understand landscape or population change; however, they usually lack an understanding of the social drivers (Zimmerer & Bassett, 2003). For example, models that forecast regional climate change may not incorporate local-level human drivers, such as land use change, even though these may present the highest vulnerability to the system (Altaweel et al., 2009). Box B-3 illustrates a few examples of social science datasets that natural science researchers can start to explore. Below, Case Studies 2 and 3 include a discussion of integrating social and biophysical data.

3. BECOME FAMILIAR WITH SOCIAL SCIENCE METHODOLOGIES

Familiarity with interviews, surveys, case studies, or discourse analyses enhances interdisciplinary collaboration and reduces the risk of misinterpretation. Even a basic understanding improves the framing of joint research. Researchers, both from academia and agencies, can start by signing up for and reading applied interdisciplinary journals that might relate to your field (e.g., Global Environmental Change, Ecology & Society, Environmental Science & Policy) to see how social science complements ecological questions. There are many resources available that can be found by searching within a management topic area. Most robust approaches tend to come from teams that include social scientists, where case studies written entirely by biophysical or natural scientists can be unreliable examples of applying evidence-based social research.

1. https://deltacouncil.ca.gov/social-science
2. https://deltacouncil.ca.gov/bay-delta-social-science-community-of-practice

BOX B-3

SOCIAL SCIENCE DATASETS

There are several open-access datasets with social metrics that serve as useful starting points for natural scientists. National and global resources include NASA's Socioeconomic Data and Applications Center, which offers gridded data on population, poverty, and urbanization; the U.S. Census Bureau and American Communities Survey provide decadal demographic assessments; the World Values Survey captures global public attitudes toward science, governance, and the environment; the Zillow Home Value Index provides information on markets and home values; and InVEST is a suite of software models for mapping and economic valuing of ecosystem services created by the Natural Capital Project.

4. CO-DESIGN RESEARCH WITH NON-SCIENTISTS

Co-design – i.e., collaboratively developing questions, methods, and goals with those affected by environmental decisions – can improve the relevance and impact of scientific work. Social science practitioners, including trained facilitators, may have excellent skills co-designing workshops to help navigate power dynamics, ensure inclusive representation, and build trust with communities. Social science researchers, on the other hand, might help to design research to learn about the effectiveness of a co-produced approach or to document outcomes. However, social scientists may play both roles in designing group processes. Navigating and documenting these types of dynamics are especially important in regions like the Delta, where diverse groups hold competing values and histories with land and water management (Delta Stewardship Council, 2025). Research co-designed with local actors is more likely to reflect real-world needs, avoid blind spots, and generate actionable findings (Beier et al., 2017; Norström et al., 2020; see also Case Study 3). For natural scientists, partnering with social scientists in this way not only enhances the use of findings but can also more directly benefit tribes and communities while helping to meet agency mandates for equity, transparency, and collaboration.

5. ADDRESS FUNDING AND CAPACITY CONCERNS

Two of the most fundamental barriers to incorporating social science on a large scale are a lack of funding and a lack of capacity. Designing research solicitations that incorporate social sciences and participatory approaches is one effective way to integrate social sciences. For example, in 2021, the Council began accepting proposals for integrated social-ecological systems research and funded two proposals in this category (see Case Study 2). By 2025, the Delta Research Awards required interested researchers to describe whether and how they were engaging with tribes or local communities – using the Council's **social vulnerability index**[3] (SoVi) – and whether and how they were employing participatory research methods. Applications with a substantial social science component earned up to 7% more points during the scoring process. The Council also assisted in identifying tribal or community partners and facilitated partnerships through a survey sent to researchers, community-based organizations (CBOs), tribes, and tribal-serving organizations to gauge research interests and needs.

To further catalyze social science integration and research, in 2020, the Council started funding a Social Science Extension Specialist (SSES) through California Sea Grant. The first SSES, Dr. Jessica Rudnick, was instrumental in launching and implementing the DRS (Case Study 1), the Bay-Delta Social Science Community of Practice, and setting the groundwork for the Tribal and Environmental Justice Issue Paper (Delta Stewardship Council, 2025).

3. https://deltascience.shinyapps.io/Delta_vulnerability_map/

Case studies

Social sciences have helped inform a wide range of questions in the Delta, including research on invasive species management, restoration, governance, interweaving Traditional Knowledge and Western Science, and many more. Below is a selection of three case studies that serve to show the role that social science can play in science and management.

CASE STUDY 1: DELTA RESIDENTS SURVEY

The 2023 **California Delta Residents Survey (DRS)**[4] was an effort to gain a deeper understanding of the people who live in the Delta. Historically, most Delta research and monitoring have focused on ecological and hydrological conditions, with less attention paid to how residents experience, influence, and are affected by environmental changes and policy decisions. The DRS sought to address that imbalance by reaching over 2,300 residents across rural and urban communities in the Delta and Delta-adjacent areas. Surveys were sent to 82,000 households, yielding a response rate of 2.9%, roughly double the typical rate for similar large-scale community surveys, indicating strong community engagement. The survey had four core goals: 1) Characterize residents' sense of place; 2) Assess the well-being of a diverse and evolving population residing in the region; 3) Understand residents' experiences and perceptions of environmental and climate change across the estuary; 4) Evaluate residents' civic engagement and perceptions of governance in the region.

Survey results highlighted that the Delta is not a homogeneous community – residents differ in what they value, what concerns them, and how they relate to the region. For example, rural residents emphasized quietness and scenic beauty, while urban residents valued recreation. Concerns about climate change were widespread but took different forms across communities. Notably, the survey also revealed disparities in well-being and access to resources, pointing to environmental justice challenges that require targeted policy responses. By capturing shared values and diverse experiences, the DRS provides insights for more effective and equitable communication, outreach, and planning. Agencies working on climate adaptation, for instance, can use these insights to tailor messages that resonate with specific communities. Furthermore, survey results showed that a majority of Delta residents trust scientific experts, local residents, and community advisory groups more than policy makers at local, state, or federal levels to make decisions in the best interest of the Delta. This underscores the importance of government agencies collaborating with local community groups, community leaders, and scientists when engaging with residents. This effort marks a significant advancement in understanding the social landscape of the Delta and is intended to be a recurring survey that can track the well-being of an evolving population.

CASE STUDY 2: COLLECTIVE ACTION FOR PHRAGMITES CONTROL

Invasive species management in the Delta presents both ecological and social challenges, particularly in mixed-ownership landscapes such as Suisun Marsh. An interdisciplinary team led by John Takekawa from Suisun Resource Conservation District (SRCD) and researchers from six academic institutions sought to **integrate social science into efforts to manage the rapid spread of *Phragmites australis* (Phragmites)**[5]. This invasive plant has increased in cover by over 230% between 2003 and 2018. Its spread across Suisun Marsh threatens the function of wetlands by impeding navigation, increasing fire risk, and reducing critical habitats for wildlife. It requires coordinated efforts across property boundaries (i.e., collective action) to achieve shared goals.

4. https://www.openicpsr.org/openicpsr/project/195447/version/V2/view;jsessionid=2E19DBE12440F0DBD4FCF4AF3FC7E657

5. https://sciencetracker.deltacouncil.ca.gov/node/52581

To address this issue, the research team conducted remote sensing to map the plant's spread, field and greenhouse experiments to study the revegetation response following Phragmites removal, and a retrospective analysis of herbicide treatments. Importantly, they also recognized that the success of invasive species management in Suisun Marsh hinges on landowners participating together in invasive species removal. To better understand these social dynamics, the team employed a combination of social science methods, including semi-structured interviews, a landowner survey, and a spatial prioritization model that identified high-value zones for Phragmites control. These approaches helped identify key factors that facilitate or hinder collective action for managing invasive plants, providing a comprehensive understanding of the extent of the Phragmites invasion.

Interviews with interested parties, including duck club members, NGOs, and government representatives, revealed widespread distrust of state and federal agencies and frustration with perceived inaction on public lands. In contrast, SRCD was consistently viewed as trustworthy due to its local presence, shared values, and strong relationships with landowners. Their spatial prioritization model for Phragmites control balanced ecological urgency with the likelihood of landowner engagement, yielding useful insights on how to build trust and improve communication. A key takeaway from this case study is that invasive species control in Suisun Marsh is more effective when it addresses the social dimensions of land management. The mixed-ownership mosaic, common in the Delta, necessitates collective action, which is facilitated when conservation efforts are grounded in trust, shared values, and meaningful collaboration.

CASE STUDY 3: PARTICIPATORY MAPPING FOR FRANKS TRACT FUTURES

Frank's Tract is a nearly 3,000-acre flooded island in the central Delta, situated at the intersection of significant ecological, social, and economic

Highlight: An aerial view of Franks Tract.

challenges. The tract is well-used for recreational activities such as boating, hunting, and fishing; however, it is also a significant contributor to salinity intrusion into the central Delta, which, during drought years, threatens the reliability of the water supply. In 2017–2018, the California Department of Fish and Wildlife completed an initial feasibility study proposing restoration to manage salinity intrusion and support Delta smelt habitat. However, the plan met significant resistance from the local community due to concerns about reduced navigability and recreation opportunities. Researchers launched the Franks Tract Futures project to co-design a suite of multi-benefit futures that ensured the local community's needs were represented (CDFW, 2020).

A key part of the project was a participatory mapping exercise – one of many social science tools – that allowed participants to map out common boating routes, pinpoint culturally important resources, and identify areas of the design that they liked or disliked. These results directly informed the design process and were made publicly accessible through an interactive map.

Despite these efforts to involve the community in the planning process, Franks Tract Futures has faced major and continuing challenges to the planning process in the Delta – a lack of trust in government-led processes, limited funding, and frustration/participation fatigue from repeated engagements that fail to deliver tangible results (Maven's Notebook, 2024). As of Spring 2026, Franks Tract Futures is in a third round of planning. For any updates, please visit: https://franks-tract-futures-ucdavis.hub.arcgis.com/.

Conclusions

This resource outlines the breadth of social sciences, dispels common myths that limit their application, and demonstrates how social science methods – from surveys and interviews to institutional analysis and participatory mapping – enhance both the rigor and relevance of conservation and water management efforts. By connecting natural and social sciences, building partnerships early, and addressing barriers such as funding and capacity, researchers and agencies can better navigate complex social-ecological challenges, foster trust with communities, and ultimately produce more equitable, actionable, and durable outcomes for the Delta.

Suggested citation

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